Atoms for Peace, or War

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RISKS OF NUCLEAR PROLIFERATION

ATOMS FOR PEACE, OR WAR

By John A. Hall

FOR a decade, American foreign policy in the field of atomic energy has energetically supported the transfer of uranium, information, equipment and complete reactors to many countries abroad. Has this Atoms for Peace Program unwittingly contributed to the development of an atomic-weapon capability throughout the world and thereby encouraged nuclear proliferation? This basic question has been brought into focus by the Red Chinese nuclear explosions and by the realization that several countries now have the necessary knowledge, materials and technicians to make nuclear weapons if they want to.

Since 1946, American policy has been based on a recognition of the fact that atomic energy is capable of both peaceful and military uses and that certain of the processes used in its development are essentially the same regardless of the final application. Early in the postwar period, then, it became our avowed purpose to establish some international control of the development of atomic energy to assure its peaceful use and, in particular, to limit and perhaps ultimately eliminate any military use.

In its continuing effort to make the atom benign through international action, American policy has gone through two distinct phases in the past 20 years. The first phase was established and governed by the Atomic Energy Act of 1946, which placed an embargo on the export of nuclear information and materials. In the same year the United States brought before the United Nations the proposals formulated by Bernard Baruch for international control of atomic energy. The principal thesis behind these early U. S. proposals was that atomic energy was so dangerous in terms of its potential military applications that international "ownership" and "supervision" were required. For example, the Acheson-Lilienthal report, which served as an important basis for the Baruch proposals, included the following statement: "We have concluded unanimously that there is no prospect of security against atomic warfare in a system of international agreements to outlaw such weapons controlled only by a system

which relies on inspection and similar police-like methods." The proposed solution to the political problem of control was supranational ownership and operation of atomic energy activities, and this was explicit in the United Nations majority plan.

Read in 1965, this conclusion is a bit startling. Disarmament plans and systems to assure the peaceful use of atomic energy both rest today in large part on the assumption that scientific inspection and verification will provide the necessary assurances of compliance. Why was the concept of international control thus limited or narrowed?

The Baruch Plan was, of course, rejected, and by 1953 the United States no longer had a monopoly of atomic technology. Despite the embargo imposed by the Atomic Energy Act of 1946, several countries, including the Soviet Union, were developing substantial atomic energy programs for both war and peace. The United Nations Atomic Energy Commission had been abandoned and essentially merged into the Commission for Disarmament. No progress was being made in disarmament, the Soviet Union had entered a thermonuclear arms race with the United States, and discussions to bring about a reduction of tensions had reached a complete impasse. At the same time, the progress made by scientists exploring the peaceful uses of atomic energy had stimulated a growing interest in the benign uses of the atom both in the United States and overseas.

It appeared to the Administration in 1953 that the American people should be informed in frank and realistic terms of the ominous consequences of the impasse on disarmament. But at the same time it was thought desirable to place some new and constructive proposals before the world, preferably in the atomic field, with the aim of converting the then dismal climate to one of optimism. It was hoped that in the process a new channel of communication could be developed between the United States and the Soviet Union. This was the background of President Eisenhower's speech before the U.N. General Assembly in 1953.

The President there recognized the important and growing promise of atomic energy in contributing to human welfare and the eagerness of many nations to avail themselves of these benefits. His Administration had come to feel that these aspirations and developments could best be contained in peaceful channels by a program of positive international coöperation under safeguards rather than continued adherence to a policy of em-

bargo. He was also aware that within the United States there was a growing interest in the peaceful side of nuclear technology and that greater progress, particularly in the field of power, might be achieved if U. S. industry were permitted to contribute.

II

Thus, the United States established a new atomic policy. It included a sharing of peaceful nuclear technology and a proposal to establish an International Atomic Energy Agency (I.A.E.A.), related to the United Nations. Domestically, it involved permitting the growth of a peaceful nuclear industry by authorizing such steps as the construction and operation, under license, of private reactors. In effect, a new Atomic Energy Act was created to give substance to what became known as the Atoms for Peace Program. The Senate report on the draft 1954 atomic energy legislation stated the rationale for the new approach:

> Today we are not alone in the drive to achieve peacetime atomic power. Eight years ago, besides the United States, only the United Kingdom, Canada, and—as we have recently come to find—the Soviet Union had major atomic energy projects in being. The possibility of coöperation with other nations to gain mutual advantage in the areas of peacetime power appeared far in the future. As against this, however, more than 20 countries now have vigorous atomic energy programs, and several of them are pressing toward the construction of atomic power plants to turn out useful amounts of electricity.
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> In 1946, our Nation earnestly hoped that worldwide agreement on international control of atomic energy might soon be secured. It was reasonable, therefore, that the original Act should prohibit an exchange of information on commercial uses of atomic energy with other nations until such time as the Congress declared that effective and enforceable international safeguards against the use of atomic energy for destructive purposes had been established.
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> But our hopes of 1946 have been thwarted by unremitting Soviet opposition to the United Nations' plan for the control of atomic energy. Although we would be morally derelict if we abandoned our hopes for the eventual effective international regulation of all armaments, legislative policy cannot now be founded on the expectation that the prospect of such control is either likely or imminent.

The 1954 policy was one of international coöperation based on a system of verification to assure that the uses in view were peaceful. While the Atomic Energy Act of that year does not specify that inspection and verification must be established as a condition for international coöperation, the Act does require that "an agreement of coöperation must include terms, conditions,

duration, nature, and scope of the coöperation by the coöperating nation; that the security safeguards and standards as set forth in the agreement will be maintained; that any material transferred under the agreement will not be used for atomic weapons, research and development, or any other military purpose. . . ."

The elements of an effective system of safeguards and verification designed to assure peaceful use were subsequently developed by the Atomic Energy Commission and the Department of State. Safeguard rights, including rights of inspection, have been incorporated in our bilateral agreements and, after considerable negotiation, many of these conditions were included in the Statute of the International Atomic Energy Agency in 1956. The I.A.E.A. has the right and obligation to apply these safeguards when granting assistance to its members. It also is empowered to apply them to arrangements and facilities voluntarily placed under its control. In general, these procedures for bilateral and international inspection and verification are similar to those which the Acheson-Lilienthal report and the first report to the Security Council considered insufficient alone to provide fully adequate international control and security.

Before examining the safeguards we need to look first at the programs themselves. There have been four major programs under the new atomic policy: the exchange of technical information, the transfer of materials (uranium, plutonium, etc.), the transfer of equipment (including complete reactors), and finally, institutional coöperation through and with the I.A.E.A., Euratom, the European Nuclear Energy Agency and the Inter-American Nuclear Energy Commission.

The Atomic Energy Act of 1954, plus a more liberal policy on the part of the A.E.C., permitted a substantial declassification of information useful for the development of peaceful applications of atomic energy. The way was thus prepared for making the first United Nations International Conference on the Peaceful Uses of Atomic Energy at Geneva in 1955 an enormous success. Aided, too, by the warm glow which followed the Summit Meeting in May of that year, the conference saw more relevant information more broadly exchanged than ever before. Because of unified policies stemming from their wartime collaboration, the United States, Britain and Canada had declassified substantially the same type of information on their respective programs. And it became apparent at Geneva that the Soviet Union had declassi-

fied a vast amount of information which for the first time disclosed that East and West were operating on basically the same principles of declassification.

The convening of the Geneva Conference of 1955 prompted the establishment in many countries of new and separate governmental organs to promote and administer peaceful atomic development, and many of the delegates were the new chairmen or administrators of these bodies. The statistics on the conference are impressive. There were 1,428 delegates present, of whom 485 were Americans. The Soviet delegation consisted of 67 members, the largest number of Soviet scientists ever to attend an international conference up to that time. The exchange of information that occurred through the presentation of papers and subsequent discussions in the various sessions of the conference was important and substantial. The majority of the scientists and administrators present were convinced that within a few years there would be a significant reduction in the cost of atomic power which would permit the construction of many nuclear generators throughout the world. This early optimism was not justified.

A second and even larger Geneva Conference was held in 1958. The commercial and governmental exhibits were huge and gave the impression of a three-ring circus. But reactor technology had not developed at the pace expected in 1955, and despite the many papers given at the conference and the further declassification of information by many countries, there was very little of significance to add to what had been known and revealed in 1955. Except in the area of plasma physics, which held long-range promise of great developments, a spirit of pessimism characterized the 1958 conference. However, by the time of the third Geneva Conference in September 1964, important progress had been made in the field of atomic power. This conference demonstrated that nuclear technology had come of age and that nuclear activity was becoming more conventional and could be discussed in more conventional terms. Clearly, we were on the threshold of competitive atomic power.

It can be argued that the massive release of information which took place at the three Geneva Conferences and through U. S. coöperative activities with other countries has contributed in some degree to a better understanding of certain military applications of atomic energy. As noted at the outset, this is an inherent problem of nuclear technology. But in order to put the issue in

perspective, two points need to be emphasized. First, as we have seen, it became evident at an early stage that even by adhering to a policy of strictest secrecy the United States could not prevent other countries from using the brains of their own scientists to identify and perfect the fundamentals of producing special nuclear materials for weapons development. Indeed, it was apparent that this basic knowledge became generally available at a very early date. Second, it cannot be stressed too strongly that the overwhelming bulk of the information that has been declassified has had very little bearing on military programs, but has been exceedingly useful in promoting peaceful uses. For example, the very great portion of the information that has been released in the field of nuclear power has concerned reactors designed primarily for the production of power rather than plutonium. The United States has retained, in secrecy, information on weapons design and sensitive production processes such as the gaseous diffusion technology in use at Oak Ridge and other A.E.C. facilities.

III

The second aspect of the new atomic policy provided for the transfer of uranium and other materials under statutory agreements for coöperation. The transfer of fissile material from the United States to another country was quite impossible before the Atomic Energy Act of 1954. In fact, the unique quality of uranium and, particularly, of uranium in its isotopic form of U-235, goes to the core of our problem of the potentially dual use of atomic energy for war and peace. Uranium-235 in a research reactor produces neutrons for research; uranium in a large reactor produces not only heat but also plutonium, which is potentially useful in atomic weapons.

The new Act permitted special nuclear material to be distributed to foreign countries in accordance with the scope and terms of each specific agreement. To assure a careful, judicious review of these transfers by the appropriate arms of the Government, the Act required that each agreement had to be submitted to the President for review and approval and then placed before the Joint Congressional Atomic Energy Committee for 30 days before coming into force. The new legal framework, therefore, liberalized the opportunities for such transfers but under conditions which provided for the most careful consideration of each arrangement.

In 1955, the President authorized the first bilateral agreements

for coöperation with Brazil, Turkey and Colombia. They provided for the transfer of small quantities of enriched uranium to the coöperating country for use in a research reactor. At the start, most countries decided to acquire research reactors which were useful for a variety of purposes, and our initial agreements were designed to be responsive to these needs. These early agreements provided for the transfer of up to six kilograms of U-235 contained in enriched uranium, but with the proviso that the U-235 not exceed 20 percent of the total by weight. Subsequently, as foreign programs expanded, this six-kilogram limit was increased in certain instances and, when technical or economic considerations warranted, coöperating countries were permitted to receive material of higher enrichment in the isotope U-235—up to 90 or 93 percent. However, as previous limits were removed or increased, more comprehensive and stringent safeguards were provided in the bilateral agreements.

In the late 1950s a few countries decided to construct nuclear power plants. In contrast to the small quantities of uranium needed in research reactors, power reactors require hundreds of kilograms. They are potentially dangerous, as we have noted, in that they produce sizeable quantities of plutonium. Accordingly, the uranium transferred for power reactors has been subject to the most comprehensive and careful safeguard procedures.

The policy of assisting countries in this manner under bilateral agreements was announced to the United Nations General Assembly by Ambassador Henry Cabot Lodge on November 5, 1954. The United States regarded its bilateral procedure in part as an interim measure pending the establishment and effective operation of the proposed International Atomic Energy Agency. It hoped that at an early stage the I.A.E.A. could assume the responsibility for administering the safeguards and control arrangements which had been created.

Under the terms of these bilateral agreements, 225,440 kilograms of natural uranium and 169,410 kilograms of enriched uranium containing 6,210 kilograms of U-235 have thus far been sent abroad. In addition, some 26 kilograms of plutonium and more than 650 tons of heavy water have been transferred under these agreements. One of the largest recipients of enriched uranium has been the European Atomic Energy Community (Euratom). Additional arrangements were concluded in 1964 for the transfer of between 400 and 500 kilograms of plutonium for joint research

on fast reactors to be done in Euratom laboratories in France and Germany, and subject to Euratom safeguards.

A third feature of the new atomic policy was to send abroad equipment, including reactors—again under statutory agreements. In the early stages, the reactors were small and the possibility of their misuse to develop plutonium for military purposes was insignificant. In the late 1950s, we sold about 25 research reactors abroad, and the Soviet Union also made reactors available to several countries including Ghana, Egypt, Jugoslavia and many of the East European countries. As an incentive, we contributed up to $350,000, but not more than half the cost of the reactor project, as an outright grant to qualifying countries. While this program is now completed, it was one of the more controversial aspects of the Atoms for Peace Program. There has been criticism that this financial incentive might have stimulated some countries to procure a reactor earlier than could reasonably be justified. Also, many developing countries did not have trained personnel or clear-cut research programs. On the other hand, a research reactor is a very useful instrument not only for basic research and the production of radioisotopes but for training and education. In the long run, therefore, these facilities could make important contributions.

It should be emphasized that the decision to purchase a reactor, including the timing of acquisition, has in all cases been made by the receiving countries. In some countries, to be sure, reactors were built primarily as status symbols designed to indicate scientific achievement. In most others, while the element of prestige may have had a bearing, they have been regarded as they should be—as tools designed to accomplish a specific research program. While a few countries have clearly gone too far too soon, let us never assume that the capability for imaginative research and scientific development is limited to a few developed countries in the West. As a case in point, one can cite the impressive research facilities at Trombay in India, which have been very productively used. India has distinguished itself by its ability within a few years to muster a large research establishment that is highly competitive in a wide variety of fields. It is significant that, in spite of the provocation of the Chinese bomb, India has reiterated its intention to devote itself to peaceful rather than military programs. Perhaps, in the last analysis, the best restraint against proliferation is found in such self-imposed limitations.

IV

The fourth aspect of the new atomic policy has been to support actively those international organizations which have as their main purpose the development of the peaceful uses of atomic energy. Two are of particular importance—the International Atomic Energy Agency and Euratom. I.A.E.A. was an American idea. One of the original purposes of the Agency was to accumulate and distribute fuel for reactors under safeguards. This purpose has never been fully realized. The availability of uranium in large quantities and the ease with which it can be procured under bilateral arrangements has made it unnecessary for the Agency to become a major distributor of nuclear fuel, although it remains an important source of supply for nations that prefer to receive their fuel from a multilateral group. On the more positive side, the development of East-West technical contacts and discussions has been effective, and in Vienna (the Agency's headquarters) the recent support for safeguards brightens the Agency's prospects for useful service.

The I.A.E.A. looks upon itself as a technical bridge between East and West. There are 91 member states, and 45 nationalities are represented in a secretariat of about 600. The executive policy body, the Board of Governors, consisting of 25 member states, meets several times a year to review budgets and program proposals made by the chief executive, the Director General. The atomic powers have permanent seats on the Board. The Agency's ability to disseminate information and equipment is modest because its budget is one of the smallest in the United Nations family. However, in the past two years the importance of the safeguard and inspection responsibility of the Agency has increased significantly. In 1963 the Board of Governors, with the affirmative vote of the Soviet Union and the United States, extended the system which had previously been applicable to small facilities to cover reactors greater than 100 thermal megawatts in size.

In February 1965, the system was revised and clarified, and received the unanimous support of the Board (Switzerland and South Africa abstaining). For the first time in postwar negotiations, we have at last seen strong East-West adherence to an international inspection system, limited though it is. In addition, the Agency is assuming a greater number of the safeguard respon-

sibilities contained in bilateral agreements. For example, 20 countries receiving assistance from the United States have agreed to submit these arrangements to I.A.E.A. safeguards. The increasing burden on the Agency has already led to serious discussions as to whether it should bear all costs of inspection.

In the late 1950s when the United States was negotiating bilateral agreements, the I.A.E.A. was in existence but as yet no agreed system of safeguards had been established. There were many critics then—and perhaps are still—who felt that the United States undermined its international position in Vienna by continuing bilateral arrangements. It was said that instead we should channel all information, fuel and safeguards through the International Agency. While this view had merit, it did not come to grips with the fact that between 1957 and 1963 many countries wanted to continue coöperation on a bilateral basis, until the International Agency proved it was viable and equipped to apply effective safeguards under agreed procedures. As long as the bilateral arrangements contained specific provisions for safeguards, inspections and verification, there was no substantive contradiction in policy.

The experience of the last few years indicates that it was sound policy to treat the Agency as a small but growing and potentially important organization rather than to give it a major responsibility from the beginning. It has, among other things, allowed time for the needs of the international community and the principal purposes of the Agency to become clear. These have grown out of a recognition that atomic energy has implications which transcend national boundaries, that the controls and regulations required range from the prevention of diversion to military use to the development of standards for the protection of the populace, including those engaged in international commerce, from the harmful effects of radioactivity.

The European Atomic Energy Community—Euratom—was established by the Treaty of Rome in 1957. It was designed to coördinate and ultimately to integrate the national programs of its member states—France, Germany, Italy, Belgium, the Netherlands and Luxembourg—and to take on selected functions that the member states felt could be performed more effectively by a joint effort. An important political purpose behind Euratom was to accelerate the integration of Europe.

The first United States-Euratom agreement, concluded in

1958, provided for a joint reactor program as well as a joint program of research and development. For a number of reasons, including the unanticipated decline in the cost of fossil fuels, the reactor program fell short of its initial goal of installing 1000 megawatts of nuclear capacity by 1965.

At the time our agreement with Euratom was negotiated, the United States had bilateral agreements with the countries who were members of the Community. It was expected that when the bilateral agreements expired they would not be renewed and the supply function would be performed solely through Euratom, which would also take over the safeguard responsibilities. In light of the guarantees provided in the American agreement with Euratom, the United States feels that this arrangement provided adequate assurances, but it has led to some criticism. As long as Euratom is made an exception, it is argued that other regional groups or large states should be given similar responsibility. Again, the answer is that the arrangements with Euratom were concluded before the I.A.E.A. had an operative system. Moreover, Euratom is unique; and the system of safeguards applied is such that the six nations of the Community are in effect inspecting each other. Therefore, the United States has felt that Euratom provides exceptional guarantees. Nevertheless, as a general matter of policy, we have favored the more broadly based international system of safeguards administered by the I.A.E.A.

The efficacy of any safeguards system depends on access and the availability of measurement techniques to verify that all of the materials involved are in fact being put to peaceful use. This is not easily accomplished. However, over the past 20 years, a greater appreciation of the need for strict internal accountability of fissile material has helped to develop techniques which can be adapted to international verification. These increasingly sophisticated methods have both reduced the possibility of deliberate diversion or misuse of equipment and material, and also developed a psychology of deterrence which has made the possibility of diversion very remote.

Despite a variety of techniques for taking material inventory (piece counting, sampling, weighing, chemical analysis, radioactivity checks), verification by direct means is not always feasible. For example, the amount of nuclear material contained in an operating reactor or in a highly radioactive fuel element cannot be measured directly. In some cases, indirect assurance can

be gained by a continuing review of an installation's operations and records, and direct assurance is finally obtained from data which becomes available when the fuel is submitted for chemical reprocessing and the amount of plutonium produced can be determined by chemical analysis.

Inspection is no longer a hypothetical or academic matter. The United States has been engaged in inspection in this field since 1955. In 1964 the A.E.C.'s safeguards staff inspected 98 facilities in 14 countries. Six of the 14 countries and 23 of the installations were inspected twice during this period, in accordance with regulations applying to larger facilities with larger quantities of material. The International Agency in 1963–64 inspected 23 facilities in seven countries.

There is no doubt that, had the United States been able to control all the variables and successfully secure adoption of the Acheson-Lilienthal proposals, we might have realized a more sure and comprehensive control over the subsequent development of atomic energy. This would have been accomplished by an international authority which itself owned and controlled a large proportion of the world's nuclear installations and research activity. However, the Baruch proposals did not find universal support, and by the mid-1950s the West was confronted with the prospect of uncontrolled traffic in atomic fuels and materials. As technology developed it also became apparent that ownership and control of atomic energy were really two discrete functions and that effective control did not necessarily depend on ownership per se. Moreover, the concept of centralized international ownership of anything as vast and complex as atomic energy was proven impracticable. The application of safeguards by on-site inspection was therefore accepted by most countries as a preferred alternative. This acceptance widened until in 1963 the Soviet Union and the United States agreed in the International Atomic Energy Agency that the safeguards system should be supported. Having reached an understanding on the procedures to be followed, the next step is to apply them as widely as possible throughout the world.

V

What, then, are the answers to the basic questions we have posed?

There is no doubt that our atomic policy of the past ten years

has contributed substantially to the spread of knowledge of nuclear energy throughout the world, and that some of this information may have contributed to an understanding of its military applications. However, it is extremely difficult to argue that the program has contributed to the earlier proliferation of nuclear weapons, since the United States has safeguarded its weapons information and, even without American involvement, many nations would have been able to proceed with either peaceful or military programs on their own. Both the Soviet Union and France developed weapons programs without any assistance. Indeed, a persuasive case can be made that the program has in fact retarded proliferation, since it has satisfied the aspirations of most nations and discouraged military programs while at the same time extending the application of safeguards. Further, it has created a general atmosphere of openness which has made it less likely that nations avowedly committed to peaceful programs might clandestinely pursue military purposes.

On balance, the United States has felt it more desirable to coöperate under safeguards than not to coöperate at all. As Dr. Glenn T. Seaborg, Chairman of the Atomic Energy Commission, recently stated in an address in Los Angeles:

> The story of how nuclear safeguards came about is the story of careful foresight in the establishment of the U. S. Atoms for Peace Program and of the continuing conscientious efforts of many scientists, administrators and diplomats, both in this country and abroad, over a period of several years. The Atoms for Peace program began with the fundamental thesis that the plentiful benefits of the peaceful atom must be shared with all mankind if we are to live up to our belief in an open community of nations free from the specter of poverty. . . .
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> There were many who felt in those early days, as some feel today, that we could somehow hold back the hands of time—arrest scientific progress—and not coöperate with other countries in providing this nuclear technology and materials for peaceful purposes. Science cannot for long be kept under lock and key. We knew that other countries could independently achieve a nuclear capability. We also knew that many countries of the world had their own supplies of natural uranium and, perhaps more importantly, their own scientists. We also considered that if we did not coöperate in sharing our peaceful nuclear technology and nuclear materials, there would be other countries—not all of which necessarily would agree to the need for safeguards —other countries which might be willing to provide nuclear materials and technology without a firm assurance as to their eventual peaceful end use. We also recognized that a multilateral control system would be more efficient and objective than bilateral safeguards and that it would contribute in the long run to the evolution of a broader system of arms limitation or disarma-

ment. It was these simple facts that led us, at an early date, to see the urgent need for a system of international safeguards and for the United States to take a major role in its evolution.

Looking to the future, the aim should therefore be not so much to stop further international assistance and commerce in this area, but rather to place all of this growing traffic under effective international safeguards. Efforts also should be made to apply safeguards increasingly to national programs that are not dependent on outside assistance. This is the big gap in the present security system and the area in which weapons development and proliferation can be foreseen. Fortunately, there is a workable solution at hand—namely, the International Agency's existing safeguards system—which has the political support of East and West.

Twenty years ago atomic activity was limited to the United States, Britain, Canada and the Soviet Union. In 1965, there are approximately 300 research reactors and 45 power reactors throughout the world. Ten years ago the United States was the principal supplier of uranium, equipment and reactors. In 1965, there are many suppliers, actual and potential. One important step to limit proliferation is to urge all suppliers of atomic materials to subject their bilateral traffic to the accepted safeguards of the I.A.E.A., as the United States has done.

A further measure, more drastic in its effect, would be to urge all countries with peaceful atomic-energy programs voluntarily to place their installations under Agency safeguards. The United States took a symbolic step in this direction last year by asking the I.A.E.A. to assume responsibility for the safeguards at the large Yankee Atomic Power Plant in Rowe, Massachusetts. Other nuclear powers ought to follow suit.

These two measures—placing international traffic as well as national programs under effective safeguards—can help control the problem of weapons proliferation and permit us to realize with growing confidence the full advantages of the peaceful atom. They obviously are not, however, panaceas for the world's security problem, nor should they be confused with more fundamental measures such as arms control. They do represent important steps that should provide useful experience for greater progress to follow.